

**CLAIMS**

1. Partial oxidation reactor that comprises:

- an elongated jacket along an axis of any orientation,
- means (12) for supplying a preheated gas that contains oxygen and optionally water vapor,
- means (9) for supplying a hydrocarbon feedstock,
- means (11) for evacuation of a hydrogen-rich effluent,
- a first internal chamber (5) inside of which is carried out an essentially isothermal partial oxidation reaction that is connected to means (9) for supplying the hydrocarbon feedstock and to means (12) for supplying preheated gas,
- gas turbulizing means that are suitable for creating a perfect mixing flow,
- means (8) for linking first chamber (5) to a second chamber (7) with a suitable volume for carrying out a piston flow, linking means (8) that comprise at least one orifice, and second chamber (7) exchanging heat in an indirect manner over at least a portion of its length with means (12) for supplying said thus preheated gas, whereby the second chamber is connected to said means (11) for evacuating the hydrogen-rich effluent,

and in which gas supply means (12) comprise an annular chamber that is essentially coaxial with the reactor jacket, and second chamber (7) is essentially coaxial with said jacket.

2. Reactor according to one of claims 1 in which second chamber (7) comprises a first essentially adiabatic zone that is linked to linking means (8) and a second zone that exchanges heat with means (12) for supplying the oxygen-containing gas.
3. Reactor according to claim 2, in which the first zone of second chamber (7) contains a vaporeforming catalyst.
4. Reactor according to one of claims 1 to 3, in which the second chamber is made of a ceramic-type material or a metallic material that is optionally coated on the side of the hot fluid by a porous or non-porous ceramic material.
5. Reactor according to one of claims 1 to 4, in which the gas turbulizing means inside first chamber (5) are selected from among the group that is formed by an internal gas recirculation ring, a baffle, and a separate injection device that is essentially in countercurrent to the feedstock, on the one hand, and the oxygen-containing gas, on the other hand.
6. Reactor according to one of claims 2 to 5, in which first chamber (5) and second chamber (7) are essentially coaxial with the reactor jacket and in which the annular chamber of the gas supply means surrounds first chamber (5) and second chamber (7).
7. Process for the production of a hydrogen-rich effluent starting from a feedstock that contains hydrocarbons, an alcohol or an oil that is

made from biomass and that uses a reactor according to one of claims 1 to 6.

8. Process according to claim 7, in which the gas that contains the oxygen is a mass ratio relative to the stoichiometric oxygen of between 0.1 and 0.6 and in which the recycling rate in the first chamber is at least equal to 25% and preferably greater than 50%.
9. Process according to one of claims 7 or 8, in which said gas is preheated to a temperature of between 800°C and 1400°C by indirect heat exchange with the effluent that circulates in the second chamber.
10. Process according to one of claims 7 to 9, in which the temperature of the first chamber and optionally the temperature of the first zone of the second chamber are between 1100°C and 1800°C and preferably between 1400°C and 1650°C.
11. Process according to one of claims 7 to 10, in which the  $H_2O/C$  molar ratio in which C designates the amount of carbon contained in the hydrocarbon feedstock is between 0 and 2 and preferably between 0.2 and 0.8.
12. Process according to one of claims 7 to 11, in which cold ignition is carried out by injecting a gaseous hydrocarbon into the oxygen-containing gas supply and by carrying out the ignition of the mixture that is obtained upstream from the first chamber.

13. Process according to one of claims 7 to 12, in which the dwell times in the first chamber and in the second chamber are between 50 ms and 1 second.